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REVIEWS.

Street Cleaning in Europe and America.

Reviewed by S. WHINERY,* M. Am. Soc. C. E., M. Am. Soc. M. E.

MODERN METHODS OF STREET CLEANING.—By George A. Soper, Ph. D., M. Am. Soc. C. E. New York; The Engineering News Publishing Co. London, England; Archibald Constable & Co., Ltd. Cloth; 6 x 9 ins.; pp. 201; numerous plates. $3, net.

The author of this little book is a well known sanitary engineer and it is quite natural that he should, in dealing with the problems of street cleaning give prominence to the sanitary, rather than the economic side of his theme. This is well, for we are too much given to treating the subject mainly from the utilitarian point of view. The popular idea seems to be that street dirt is inconvenient, ugly, injurious to property and derogatory to the good name of a city. The fact that it is a serious menace to the public health, while recognized by the more intelligent, seems not to be appreciated by the great mass of the public.

Briefly, the book may be divided into two chief parts. The first few chapters are devoted to a general discussion of the theory and practice of street cleaning, and the remainder of the book to descriptions of street cleaning methods and practice in a number of foreign cities and in New York. In the first part will be found a clear and sound exposition of the principles that should control in street cleaning and matters relating thereto, and a discussion of current practice here and abroad.

In his "Foreword" the author says:

> It was once my hope that a study of street cleaning methods in different cities would enable me to deduce some principles of general application, especially as to efficiency and cost, but the nature of the work and the character of the information available does not admit of many precise deductions of this kind. Numberless conditions of pavement, of traffic and of weather, not to mention different sanitary standards, make it impossible to treat this subject in the severely analytical method common in engineering discussions.

This has been the discouraging experience of other engineers with a laudable ambition to write something on the subject that would be worthy of the name of an engineering treatise. The obstacles met with in such an attempt are not all stated in the above quotation, and the most serious one is not mentioned. The simple fact is that the material data needed for a satisfactory treatment of the subject either do not exist or are not obtainable. It is safe to say that in no other department of municipal work has there been so little attempt to observe, record, collate and make public exact facts and statistics in a systematic, not to say scientific manner. If any one doubts this let him attempt to find out from the street cleaning department of almost any city the fairly accurate unit cost of any of the ordinary methods of street cleaning. The explanation of, or excuse for, this state of affairs is very aptly stated by the author in the sentence, "Street cleaning has not yet emerged from the state of a nondescript kind of emergency undertaking to the position of an effective art."

Chapter I, from which the above quotation is taken, is devoted to a portrayal of the origin and progress of street cleaning efforts in the average growing city, a general discussion of the prevailing conditions in American cities and the importance from a sanitary point of view of clean streets.

Chapter II is entitled "Fundamental principles applicable to street cleaning" and while brief, is a fair statement of the elementary, and, one might almost say, axiomatic principles that should control the practical operation of street cleaning, but a good many of which are constantly disregarded in every city.

In Chapter III the usual methods and practices of street cleaning are outlined and commented upon.

Chapter IV entitled "The disposal of refuse" is a very brief and inadequate outline, even from the street cleaners point of view, of a large and important subject.

With Chapter V begins what will be found by most engineers as well as by the public, to be the most interesting and valuable part of the book. This and the succeeding eight chapters would themselves make a very interesting and valuable little book under the title of "Street Cleaning and Sanitation in European Cities." In fact these nine chapters occupy fully two-thirds of the present book, and may be considered the raison d'être for the volume.

In addition to Dr. Soper's previous study and experience in street cleaning, he was, when going abroad two years ago, commissioned to make observations and collect data in European cities for the use of the Commission on Street Cleaning and Waste Disposal, which had then been recently appointed by the Mayor of the City of New York. The results were embodied in a general statement to that Commission, which was printed in its report. In the present book a more extended and detailed account of his observations and the facts obtained are now for the first time published. Dr. Soper is a trained and competent observer, and his reputation as a sanitary engineer and the credentials he carried abroad opened to him sources of information not accessible to the ordinary traveller. It is not surprising then that we find in his book the most satisfactory description at present extant of the latest street cleaning practice in European cities. While methods and results are chiefly dealt with, there is scattered through these chapters many interesting items relating to general and unit costs of work.

The first chapter dealing with this subject (Chapter V) is a summary or review of "European Methods of Street Cleaning." This is followed by chapters on street cleaning and allied subjects in the cities of London, Westminister, Manchester, Paris, Berlin, Hamburg, Cologne and Amsterdam,—a whole chapter being devoted to each, in the order named. Any attempt by the reviewer to abstract these chapters would be unsatisfactory. The text is concise, the pages bristle with interesting facts and comments and if one attempts to abstract or condense he will find it difficult to do so without omitting valuable matter.

Like other observers the author found the pavements in most of these European cities to be kept in a much cleaner condition than are the pavements in American cities; but this is not wholly due to the more efficient organization and management of street cleaning departments abroad. The better structural condition of the pavements themselves will, partly at least, account for the fact.

"Wherever the streets of European cities are well cleaned the pavements are in good repair. It is recognized by the authorities that not only is the cost of cleaning dependent upon the condition of the pavements, but it is appreciated that it is quite impossible to keep bad pavements clean." This is a fact which our American cities seem slow to learn and act upon. We do not yet properly appreciate the dependent relation that exists between the usual bad state of repair of our pavements and their dirty condition, and are prone to point to the better results abroad as conclusive evidence of the inefficiency and extravagance of our street cleaning departments.

Another lesson which these foreign cities have learned in advance of us is that street dirt must be dealt with in two different forms or conditions, a primary and a secondary form, the latter being street dust,—and that no method of cleaning that does not effectually remove both these forms of street dirt can be satisfactory. Also that the secondary form, street dust, is by odds the most dangerous to the public health, and the most injurious to city property.

The last chapter of the book describes briefly and rather unsatisfactorily, street cleaning methods and results in the city of New York. Its chief interest will be found in the contrast between the efficiency and cost of the work abroad and here.

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The Treatment of Trade Wastes and the Sewage of Manufacturing Cities.

Reviewed by GEORGE W. FULLER,* M. Am. Soc. C. E.

ABWASSERBESEITIGUNG VON GEWERBEN UND GEWERBEREICHEN STAEDTEN.—Unter Hauptsächlicher Berücksichtigung Englands. By Albert Schiele, Member of the Royal Testing institution for Water-Supply and Sewage Disposal at Berlin. Berlin, Germany: August Hirschwald. Paper; 6¼ x 9¼ ins.; pp. 932; 179 illustrations in the text, and 27 tables. 24 marks; American price, $9.60.

This interesting book on the treatment of trade wastes and the sewage of manufacturing cities with especial reference to English experiences, has been written by a well-known German engineer, now a member of the Technical Staff of the Royal Testing Station at Berlin, and formerly engaged in municipal engineering in China and Japan.

In his introduction, stating the purpose of the book, he makes plain the importance as well as the difficulty of treating trade wastes. As to normal city sewage, he states that, according to the views of the Berlin Testing Station, knowledge has so advanced that further developments in the solution of special questions can scarcely be treated by investigations at a central station, but that progress has to be made through adaptation to the local conditions of the individual problem by the city itself. At present we know what processes to adopt for ordinary city sewage in various individual cases in order to adapt the project to the local conditions with reference to stream flow, etc. The design should be made so that the works may be modified in the future as seems desirable or necessary in order to avail of the results obtained from practical operations, if this can be done without difficulty.

Essentially different, he states, is the treatment of trade wastes, or of city sewage highly charged with the same. It is difficult to avail of experiences along these lines, owing to the absence of carefully prepared and critical descriptions of the available experiences dealing with such cases. The purpose of this book is to gather together information obtained in this field, especially the vast fund of information available from England. Preparation for this work was

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begun some four years ago, when a three weeks' inspection trip of English plants was made by the author and by Prof. Dr. Thumm. Pages 131 to 392 are devoted to careful descriptions of various English plants, of which 15 were actually studied by the author on the ground and including a large number of representative English municipal sewage works such as are ordinarily visited by sanitary engineers from other countries. With them are also included descriptions of disposal plants for 21 industrial establishments which were visited by the author; and further a description is given of 28 additional city purification plants and a few industrial plants that were not personally inspected.

The book is written from the standpoint of the engineer and the administrator of sanitary affairs, and does not pretend to enter into all technical details. In fact, it is stated in the Introduction that it is not the purpose to enter the field of chemistry, although in the same paragraph it is made plain that purification projects of substantial size for trade wastes should receive the combined efforts of the chemist trained in purification experiences, and of the sewage engineer, who should make comprehensive experiments before undertaking large projects.

The first 130 pages of the book are devoted to a review of the early growth of industrial districts in England, setting forth the conditions as to industry, population, stream flow, etc. English laws beginning with 1842 are reviewed in some detail, and a comprehensive outline is given of the work of the various rivers pollution commissions, the Local Government Board, the Royal Commission on Sewage Disposal, and particularly to the various conservancy boards operating in England to correct the gross pollution of the streams in the congested manufacturing areas. This portion of the book emphasizes the care with which the Germans in so many fields study thoroughly developments in other countries in order to facilitate development at home. This first section of the book is largely a record and digest of official developments in England, and to the sanitary engineer there is but little that is new. Perhaps the point of most importance is the statement and discussion of the customs and the merits of different manufacturing cities as regards individual purification plants for trade wastes in contradistinction to the discharge of the wastes into the municipal sewer system, and the conditions, restrictions and taxes for so doing. This part of the book contains some references and comments as to the relation between English and German conditions. In fact, this feature comes still further to the front in studying the appendices, of which Appendix I. (19 pp.) contains a synopsis of the English sewage disposal laws from 1842 to the appointment of the present Commission on Sewage Disposal. Appendix II. (12 pp.), states the conditions under which trade wastes are received into municipal sewers at seven of the principal manufacturing cities of England. Appendix III. (15 pp.), contains similar statements as regards trade wastes entering the sewers of some 19 German cities. These laws are of value for reference as regards the restrictions as to temperature, destructive chemicals, retention of sludge and rate of discharge into the city sewers.

Pages 131 to 392, as already stated, are devoted exclusively to a good general statement of engineering features, methods employed, costs and work performed, at 67 purification plants divided into three groups, as above mentioned. Following a general synopsis of the methods of purification encountered in English practice, there is next given a description, pp. 427-512, of the purification of 11 different types of trade waste, including wool wastes, spinning and weaving mill wastes, bleachery wastes, dye wastes, finishing works wastes, brewery wastes, tannery wastes, paper wastes, metal works wastes, chemical works wastes, and coal-washing wastes.

The descriptions of these works are careful accounts of actual practice with occasional notes as to ease of accomplishment and as to the difficulties which have not yet been fully met. This portion of the book in some ways resembles the book written some six or eight years ago by W. Naylor on Trade Wastes. It is much less technical, however, particularly as regards the chemical standpoint of the processes, than the German book written some ten years ago by Prof. Koenig, Director of the Agricultural Experiment Station at Münster, Saxony.

To the general reader of sanitary engineering literature, the portion of the book (pp. 512-752) of greatest interest relates to the descriptions of the purification processes and their respective accomplishments. These include screens, grit chambers, preliminary clarification basins and filters. They comprise an intelligent and comprehensive review of current English practice that is valuable for reference. So-called biological filters form a conspicuous part of the works described, and naturally these filters are discussed at length as to their various essential features of construction and operation. The importance of preliminary treatment is clearly recognized. Some 15 pages are devoted to the chemical treatment and clarification of trade wastes and the sewage of manufacturing cities. The septic treatment is touched upon rather lightly. Biological filters are discussed in about 35 pages, while 65 pages are devoted to a comprehensive review of the distribution of sewage over various filters. In the discussions, references are made occasionally to German experiences and now and then to American work.

To those familiar with English practice, perhaps the most instructive portions of the book are pp. 752-801, which embody valuable comparative summaries, in convenient form, of the amount of sludge in various waste liquors, and the cost, not only of sludge treatment but also of construction and operation at the various plants under consideration.

The conclusions (15 pp.) are of importance in amplifying the viewpoint expressed in the introduction and in setting forth the general procedures which the author believes could with advantage be followed in Germany in solving this line of problems.

The book is well gotten up, with adequate table of contents, index, bibliography, glossary and some 179 illustrations.

THE PURIFICATION OF SOME TEXTILE AND OTHER FACTORY WASTES.—By Herman Stabler and Gilbert H. Pratt. Prepared in cooperation with Rhode Island State Board of Health. Water-Supply Paper 235, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 76.

The cooperative work undertaken by the U. S. Geological Survey and various state agencies is producing an increasing volume of valuable information for both local and general instruction and use. The trade wastes studied jointly by the Survey and the Rhode Island State Board of Health, as presented in this report, included wastes from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton goods, and also those in the manufacture of oleomargarine, fertilizer and glue. In each case the report presents a brief statement of the manufacturing processes involved, so as to give a general idea of the wastes-treatment problem under consideration. This statement is followed by available methods of treating the wastes for purification purposes, both with and without regard to the recovery of salable products. The experimental work done by the cooperating agencies is reviewed, references are made to other studies, and finally a general summary is presented for each class of wastes.

A BRIEF HISTORY OF CEMENTS.—Including the World-Famed Portland Cement. (By I. C. Johnson, Gravesend, England.) Kansas City, Mo.: The Cement Record Co. Stiff paper; 6 × 9¼ ins.; pp. 27; illustrated. 50 cts.

Mr. Johnson, who, at the age of 99 years, is still president of the British cement manufacturing firm bearing his name, in the early part of the last century became connected with the lime industry of Great Britain and was among the first to carry on experiments toward developing an artificially-mixed cement. The little pamphlet noted above, written in the tenth decade of the author's life, presents his claims to be called the real inventor of Portland cement.

Richards' Ore Dressing Extended.

Reviewed by W. G. HALDANE*

ORE DRESSING.—By Robert H. Richards, LL. D., Professor of Mining and Metallurgy at the Massachusetts Institute of Technology, Boston, Mass. In four volumes. Vols. III and IV. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 1199 to 1619 and 1611 to 2052; 300 illustrations in the text. $5 net, each.

Previous to 1903, when the admirable work on Ore Dressing by Prof. Richards first appeared, the only literature to be found on this important subject was confined to trade catalogs and an occasional chapter or two in texts on mining or metallurgy, and at best was widely scattered and very meager.

The above-mentioned work, comprising two volumes, has since been our standard literature, but owing to the rapid strides made in ore-dressing machinery and appliances in the last few years, a marked revision of the work has been made necessary.

This revision has been accomplished by the author in the publication of two additional volumes, which are intended to supplement but not supplant the original work, and while such a scheme necessarily involves some repetition, careful indexing has brought this down to a minimum. A study of Volumes I. and II. shows the practical impossibility of rewriting these volumes to bring them up to date, and the scheme adopted by the author appears to be the only feasible way.

Before taking up the new volumes a general idea of the contents of the old ones will be given. Volume I., as will be remembered by all interested in the art of ore dressing, deals with the subject in a logical, systematic, painstaking manner, characteristic of all the work of this author, and is presented in a way to be of value to the teacher and student as well as to the manufacturer and the practical worker. An important and valuable feature of the book is the complete bibliography accompanying each chapter.

After a short discussion concerning the general principles involved in the dressing of ores, the author goes into minute detail regarding the theory of crushing, fine grinding and pulverizing, with comparisons, showing the relative advantages and disadvantages of typical forms of such apparatus as regards initial and maintenance costs, capacities and design, and results as effected by varying conditions. Part II. of this volume deals with concentration and the preliminary steps involved in this operation, such as hand picking and sorting, washing, screening and classifying. Each subject is carefully discussed from the theoretical as well as the practical point of view. The various makes of machines used in these operations are considered at length, accompanied by exhaustive data and numerous illustrations.

Some 250 pages are devoted to the laws of jigging as an application of hindered settling, and the numerous types of machines coming under this head. Here again we find a mass of useful data, gleaned by the author from a study of commercial plants, such as the wear of screens, concentration effected, analyses of heads, tails and concentrates, pulsations per minute, water required, etc.; all indicative of the thoroughness and completeness with which the matter has been studied.

The second volume devotes about 80 pages to the principles involved in, and a discussion of various makes of concentrating tables, vanners and slimers.

While some may doubt the advisability of treating the subject of amalgamation in such a work, the insertion of a chapter of 60 pages seems to be justified in the results obtained. Care and dressing of plates, slope and comparison of various amalgamating devices serve to give the reader a comprehensive view of the whole subject and the best practice.

Owing to the small amount of work done and the inefficiency of magnetic, pneumatic and flotation processes, up to the time of publication of this volume, comparatively little space is devoted to these subjects, about 45 pages being used in a

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discussion of theoretical basis and a description of the more successful machines in use at that time.

Under the head of Accessory Apparatus, a very short chapter is given over to samplers, automatic feeders and conveying machinery, such as belt conveyors, bucket elevators, sand pumps and launders. The remainder of this volume, covering some 300 pages, is given over to a general outline and flow sheet of numerous commercial plants studied by the author, and accompanied by sectional drawings to illustrate typical processes.

Volumes III. and IV., constituting the recent addition to this important treatise, may now be considered. The remarkable development and rapid advancement in the art of ore dressing within the past few years, due to the introduction of new machinery and apparatus, and improvement in design of the older forms, resulting in increased efficiency; automatic and mechanical handling of material; the successful application of magnetic and electrostatic separators and flotation processes to certain ores, has been manifest to everyone interested in this line of work, and is forcibly impressed upon the reader by even a casual perusal of these two volumes.

As an illustration of this point, Volume II. contained little more than mention of the Wilfley table, which, at the time of preparing material for the volume, was just in the process of introduction to the ore-dressing public. Later results by this machine were almost revolutionary in character. As the author aptly states, the appearance of the Wilfley table, while an extremely fortunate event for the cause of ore dressing, was most unfortunate for the preparation of the first work.

In Volume III., then, we find the matter of the earlier volumes brought up to date, chapter for chapter. About 150 pages are needed to discuss new principles involved in crushing, grinding and pulverizing, with descriptions, data and comparisons of the recent, successful machines, and improvements on the older forms. Modern tube mill practice is fully discussed, and valuable data is incorporated concerning power and efficiency of this machine as compared with other pulverizers.

The Nissen stamp, triplex rolls, and considerable additional information concerning jaw and gyratory crushers, spring and rigid rolls find a place in these chapters.

Many new devices have come into use recently in sand and slime separation in the cyanidation of gold and silver ores, and in hydraulic classifiers, not the least of which among the latter is the machine put upon the market by the author himself. The design of this latter apparatus and the results obtained in the vast amount of experimentation carried on in its development, indicate his complete familiarity with the laws governing hydraulic classification.

Little that is new has been accomplished in jigging practice, nearly all the efforts being directed toward greater capacity and a smaller water ratio. That these attempts have met with not a little success is manifested in the several new designs, such as the Hancock, Century and Richards jigs, which are fully described and illustrated, and compared with the standard forms.

Some data from additional tests on free and hindered settling, which should be of value to the student, are here given.

Probably no branch of ore dressing has received more attention in recent years than that of table concentration. Since the introduction of the Wilfley, innumerable patents have been taken out, on head motions, surfaces, riffles, feeds and minor details, and a mass of information gained from the investigations. The author deserves considerable credit in systematizing this vast fund of data, and picking out only those machines for discussion and illustration which show real merit. In this connection, the development of the slimer is also considered, and successful designs illustrated and described.

Under Miscellaneous Processes of separation, including magnetic, electrostatic and flotation processes, which received little more than mention in the earlier volumes, the modern developments are thoroughly discussed, machines described and illustrated, and the adaptability of the processes to typical conditions considered.

Volume IV. is devoted entirely to a complete description of some ninety mills, illustrating typical processes, and noting improvements and changes in older designs and flow sheets. The general arrangement of these outlines, a study of which is greatly facilitated by a "key" explained by the author, is commendable.

In a work of the scope and magnitude of this one, more care in placing diagrams and tabular data might be expected, but on the whole this is of minor moment, and the work should commend itself as the standard to the millman, the engineer, the manufacturer and the student—in short, to everyone interested in ore-dressing practice.

A Matchless Treatise on Light and Radiation.

RADIATION, LIGHT AND ILLUMINATION.—A Series of Engineering Lectures Delivered at Union College. By Charles Proteus Steinmetz, A. M., Ph. D. Compiled and Edited by Joseph LeRoy Hayden. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 305; 127 illustrations in the text. $3, net.

A deep mathematical treatise has come to be expected from Dr. Steinmetz's pen rather than a descriptive or expositive work. Symbolic statements of derived principles—"mathematical shorthand," so to speak, are looked for rather than word pictures of phenomena. But all who have heard him lecture or discuss convention papers have admired the general simplicity and directness of his oral explanations and the clearness of his mental pictures. It is safe to say that there is nowhere a more popular lecturer on physics than Dr. Steinmetz. A volume based on his talks, rather than upon his writings, therefore, one would naturally expect to be of very general interest and to secure general appreciation. "Radiation, Light and Illumination" is such a book.

If critics are not inclined to call this book a classic, it must be because of its unconventional literary form. It is obvious that it is built up from stenographer's notes and while to those who like to hear Dr. Steinmetz lecture, there is a certain vividness in this form, yet, to those who do not know the author, this effect is lost. One instance of this (p. 35) will suffice:

> As the eye perceives only the resultant of radiation, very different combinations of radiation may give the same impression to the eye, but when blotting out certain radiations, as red and green, in the mercury lamp, these different combinations of radiation may not give the same resultant any more; that is, become of different colors and inversely, different colors, which differ only by such component radiations as are blotted out by an illuminant, become equal in this illuminant. For instance, a mixture of red and blue, as a diluted potassium permanganate solution, appears violet in daylight. In the mercury light it appears blue, as the red is blotted out, and in the light of the incandescent lamp it appears red, as the blue is blotted out.
>
> I show you here, in the light of an incandescent lamp, two pieces of black velvet. I turn off the incandescent lamp and turn on the mercury lamp, and you see the one piece is blue, and the other black.
>
> This tube of copper chloride crystals appears bright green in the incandescent lamp. In the mercury light it is a dirty white. The excess color, green is blotted out.
>
> These crystals of didymium nitrate, which are a faint light pink in daylight, are dark pink in the incandescent light. In the mercury light they are blue: the color is a mixture of red and blue, and the one is blotted out in the mercury light and the other in the incandescent light.

Such notes as those quoted are very suggestive to the teacher, but they are far less appealing to the general reader.

The comprehensiveness of the subject matter, the interesting ways in which phenomena are described and the novel viewpoints are those of no merely transient book. In scope it surpasses even Palaz's treatise, though it does not present details as does that older work, nor is there a single reference for extended study of those brief and general statements for which the author cannot be the original authority.

The book starts out with the proposition that radiation is one distinct form of energy which can be converted to other forms. The author states, for instance, that it is incorrect to speak of radiant heat, as such radiated energy does not exist as heat at all until some obstacle is interposed.

The book is arranged in 13 lectures, the first of which, as would be expected, is a resume of radiation phenomena generally, of measurements of the velocity of light and of interference phenomena to show that light is a wave motion. The second lecture is entitled "Relation of Bodies to Radiation" and takes up such topics as refraction, diffraction, reflection and the colors of bodies by reflected or by transmitted light.

This is followed by "The Physiological Effects of Radiation." In addition to a brief but clear presentation of the phenomena of vision, so far as man has been able to analyze it, there is a summary of the optical pathology of light. This a wide variety of readers will appreciate, for in no similar work has it been given. The general pathology and therapeutics of light and allied radiations are also discussed. The evil effects of light on the eye are separated into two general classes. The first, termed "power burns," includes those immediate and acute troubles caused by too much or too concentrated light of ordinary wave lengths. The second, termed "ultra-violet burns," includes the more insidious attacks of radiation of wave lengths just above those of the visible spectrum.

The fourth lecture, on "Chemical and Physical Effects of Radiation," is chiefly on light and plant growth, on fluorescence and phosphorescence. This completes a quarter of the book and closes the work on effects. The remaining part treats the production and utilization of light (and to a much lesser extent of all allied radiations as well).

Two long chapters, or lectures as they are called, cover the varied phenomena of incandescence and luminescence. These are followed by "Flames as Illuminants" and "Arc Lamps and Arc Lighting." The first of these presents two materials which will be new to most engineers who have not studied that field of gas engineering. The conditions under which flames will be rich enough in proper hydrocarbon compounds to be luminous and will not be too rich to give a smoky flame are briefly outlined.

In the remainder of the book, nearly half, the author leaves what perhaps we may best call the "realm of pure physics" for the practicalities of commercial lighting—"illuminating engineering" as we have been led to call it.

There is, to begin with, a lecture called "The Measurement of Light and Radiation" which takes up in a most general way the principles of photometry. The author emphasizes the idea that physiological vagaries must always enter. In "Light Flux and Distribution" equations and curves are deduced for the distribution of luminous emanations from points, circular planes, concave and convex spherical areas, straight and circular lines, cylinders, annuli, and for various combinations of these as an incandescent filament. The difference between diffracting and diffusing globes (our most common examples being frosted and opal glass, respectively) are explained as we have seen them nowhere else. It is shown why a diffusing globe softens and modifies the light distribution according to its own shape, while a diffractor merely cuts down the glare without materially altering the angles of maximum and minimum distribution. In "Light Intensity and Illumination" the author states the great requirement of artificial lighting as the securing of various degrees of uniform illumination over extended or limited areas. Typical curves of light distribution are constructed for several cases, and it is expected that these distributions will be approximated by combinations of lamps and shades now on the market.

The final lectures of the book are on the physiological and artistic sides of artificial lighting, though the author does not "talk art" and shuns the word "artistic."

TRACK ELEVATION IN CHICAGO.—Compiled by the Track Elevation Department of the City of Chicago. Pub. Doc. Cloth; 7 × 10¼ ins.; pp. 1061; 3 general maps and about 30 folding plates of plans and profiles of work covered by different ordinances.

This bulky volume consists mainly of the several city ordinances and park board ordinances

relating to track elevation, the ordinances being given in full and in chronological order. Those of the city (1882-1908) occupy about 800 pages and those of the park boards about 177 pages. There is also a general statement of the track elevation situation in Chicago, and the policy of the city government in relation to it. The other matter includes a tabular summary of the length and cost of track elevation, number of subways, types of bridges, analysis of grade-crossing accidents, list of ordinances, etc. The preparation of these records has been under the direction of Mr. Walter J. Raymer, Commissioner, and Mr. M. K. Trumbull, Engineer of the city's Track Elevation Department. An article based on the general statement noted above, was published in our issue of June 3, 1909, together with a map showing the completed and projected work.

History and Practice of Municipal Garbage and Refuse Disposal in America.

THE COLLECTION AND DISPOSAL OF MUNICIPAL WASTE.—By William F. Morse, Consulting Engineer. New York: The Municipal Journal and Engineer. Cloth; 6 × 9¼ ins.; pp. 462; 92 illustrations in the text, and 72 tables. $5.

Mr. Morse has had a longer and more intimate acquaintance with garbage and refuse disposal by burning, as practiced in this country, than any other man in America. Beginning in the late '80's as the New York representative of the pioneer company engaged in building garbage crematories, he has continued in the business ever since, either as a representative of the company named or of later concerns of which he has been a leading spirit, or as an independent factor. He has taken a broader interest in the subject than other American builders of garbage and refuse furnaces; moreover, he was the first American builder of garbage furnaces to recognize the superiority of British refuse-furnace practice and to take a hand in the commercial introduction of the British refuse destructor into this country.

Mr. Morse has long been engaged in collecting information regarding refuse disposal in America. During the past few years he has taken great pains to make this information as complete and as accurate as possible, and to get it into orderly shape for the benefit of others. The result is the book before us, which we believe will long stand as the most complete exposition of the first quarter-century of the evolution of garbage and refuse disposal in America.

In case any one betters Mr. Morse's book in future, it will be by giving more attention to garbage reduction (the extraction of grease in the production of fertilizers and tankage) and to the exposition of the art and science of burning municipal refuse, as distinct from the history of the subject and descriptions of various furnaces. It is not surprising that Mr. Morse's book should be less strong on the garbage-reduction side, since all his activities have been with cremation and since all the reduction plants, with the exception of one purchased a few years ago by the city of Cleveland, have been built and operated by very close corporations, making it often quite difficult to gain information regarding their operations. Nor is it strange that even on the cremation side, with which he is so familiar, Mr. Morse has produced a book which is largely historical and descriptive, rather than an engineering treatise, for American refuse-burning practice up to three years or so ago was on a very unscientific and generally unsatisfactory basis. Moreover, we already have the excellent technical treatise of Mr. W. F. Goodrich, on "Refuse Disposal and Power Production," which is an exposition of British theory and practice. This technical treatise by Mr. Goodrich, together with the American books on burning refuse published prior to the appearance of this one by Mr. Morse, makes it less necessary than would otherwise be the case to attempt a distinctly engineering treatise on refuse burning.

In the first portion of his book, Mr. Morse makes some preliminary observations on the present condition of waste collection and disposal in American cities. He then presents a classification of municipal wastes, and subsequently takes up the collection and disposal of miscellaneous refuse and rubbish, other than either garbage or ashes. A chapter on Ashes follows.

In Part II. the author first gives a historical sketch of garbage crematories, as the first American furnaces for burning garbage alone were called. The author next presents a "Chronological List of American Municipal Crematories," which includes a considerable amount of valuable information which he has collected and compiled with great pains. Besides dates of construction, this table gives the number of furnaces in each installation, the location, type of furnace or name of builder, number of patent, contract price or cost, capacity in 24 hours in yards and in tons, date of discontinuance of the furnace, and a column of remarks. Altogether, 208 instalments are included in this table, but these embrace a few which were not municipal, these exceptions being included in order to show the historical development of American furnaces. Although the first of these furnaces was installed in 1885, over half of them are now no longer in use.

Another tabular list deals with garbage crematories and rubbish incinerators for public and private installations.

Various types and makes of American furnaces are next described, after which there is a brief chapter on portable crematories. Included in the last-named chapter are some figures on calorific values of waste materials.

Two chapters on British destructors are given. The first of these contains both general information and descriptions of three or four American installations of British destructors. The second chapter in Part III. is entitled "British Destructors Throughout the World," and was prepared especially for this book by Mr. Goodrich.

Part IV., of six chapters, is devoted to the history of garbage reduction in the United States, with descriptions of the Merz, Simonin, Arnold, Chamberlain, Edson and other processes.

The final chapter takes up "Revenue to Be Had from Waste Materials" and "Methods of Utilization." Recovery of waste paper and other salable materials by sorting is discussed, as also the utilization of waste for steam power. There are special articles by C. H. Koyl on "Utilization of City Ashes," and by F. C. Tryon on "The Disposal of City Waste by Gas Producers."

Considering now the volume as a whole, it may be noted first of all that, although the title includes collection of waste, the book does not contain very much on that subject. That, however, is a minor matter. The arrangement of the volume is in some respects poor. This appears to be chiefly due to the fact that a large part if not all of the material presented was first published serially ("Municipal Journal and Engineer"). The publication extended over several months, and, as the author was constantly adding to his collection of material during that period, he could not quite resist the temptation to insert some information out of its proper place. Unfortunately, this matter was not redistributed before publication, at least not wholly so.

Another minor fault of the book is due to the fact that the author has not quite cleared his mind of the old misconceptions as to the relation of garbage disposal to public health. While he does not say much on this subject, he makes that relation more intimate than the facts warrant.

The book as a whole is a valuable addition to municipal and engineering literature. Those who wish to pursue the subject further and as presented by other authors may consult the following books, which have been reviewed in these columns under the dates named: "Refuse Disposal and Power Production," by W. F. Goodrich, Assoc. Inst. M. E., Aug. 18, 1904; "The Disposal of Municipal Refuse," by H. de B. Parsons, M. Am. Soc. C. E., M. Am. Soc. M. E., May 17, 1906; "Garbage Crematories in America," by W. M. Venable, Assoc. M. Am. Soc. C. E., Assoc. M. Am. Inst. E. E., May 17, 1906; and "Heat and Light from Municipal and Other Waste," by J. G. Branch, M. Am. Soc. M. E., May 17, 1906.

The Problem of the Unemployed.

UNEMPLOYMENT.—A Problem of Industry. By W. H. Beveridge, Stowell Civil Law Fellow of University College, Oxford; late Member of the Central (Unemployed) Body for London. London and New York: Longmans, Green & Co. Cloth; 5¾ × 9 ins.; pp. 317. $2.40, net.

The problem of the unemployed seems to have been given far more attention in Great Britain than in this country, probably because it is much more pressing there than here. Mr. Beveridge here records the results of a notably dispassionate, painstaking, analytical investigation of the problem, primarily as it presents itself in England. While his details are drawn from British sources and his conclusions apply more particularly to conditions in Great Britain than to those of any other country, yet his conclusions are largely applicable in any of the great industrial countries of the world.

After the general survey of his subject and its limits, the author takes up percentages of unemployment as shown by various trades-union and government records. He then presents some studies of seasonal and cyclical fluctuations of demand for labor. Although he confesses his inability to formulate any law governing the cyclical fluctuations, yet his study of these serves to show the absolute necessity of taking them into account if the evils of unemployment are to be reduced.

In the chapter on "The Reserve of Labor," it is shown that, no matter what the state of industry, unemployment is never reduced to zero. In a chapter entitled "Loss and Lack of Industrial Quality," there are first considered changes in the general industrial structure of society, including the decay of particular trades, new processes or machines, new forms of labor, and a shifting of industrial centers. The author next takes up the influence of advancing years on industrial workers, and then considers deficiencies of industrial training. Under the latter topic, considerable information and opinion is brought out which affords a strong argument for the need of vocational training, a subject much to the front within the last few years. Casual laborers, who make up so large a percentage of the great body of unemployed, are very largely drawn from the ranks of those whose education terminates at 12 to 14 years of age, and who spend the next few years in chance work, thus losing the value of school discipline and what little education they have gained as well, while at the same time forming habits of indolence and irregularity. A companion chapter deals with "The Personal Factor." Important as this is, one would infer that the author considers it as a relatively minor topic, at least under present industrial conditions.

A chapter on "Remedies of the Past" reviews the working of the British Poor Law, so-called municipal relief works, the administration of special charitable funds for the benefit of the unemployed, and then takes up the comparatively recent Unemployed Workmen Act of the British Parliament. The section dealing with municipal relief works is well worth the attention of students of both the unemployed problem and the municipal administration problem in this country. From what is said under this head and also regarding national relief works, farm colonies, etc., it would appear that the evils of unemployment are never permanently helped and are perhaps aggravated by attempts at governmental provision of employment, whether this be national or municipal.

The portion of the book thus far reviewed is chiefly analytical and descriptive. There follow two chapters of constructive matter under the general heading "Principles of Future Policy." The first of these chapters deals with "The Organized Fluidity of Labor" and the second with "The Averaging of Work and Earnings." We can best give an idea of these chapters and of the net result of the whole study by quoting a few sentences from the author's own summary, as follows:

> Unemployment is not to be identified as a problem of general over-population. . . . Unemployment arises because, while the supply of labor grows steadily, the demand for labor, in growing, varies incessantly in volume, distribution and character. . . . Fluctuations

of demand are now provided for by the maintenance of huge stagnant reserves of labor in varying extremities of distress. There is no reason in the nature of things why they should not be provided for by organized reserves of labor raised beyond the reach of distress. To be able to follow the demand men must possess greater powers of intelligent movement from place to place; they must possess also power to move from trade to trade, or—a more essential point—*they must have better guidance in the first choice of occupations.* [Italics ours.—Ed.] To be able to wait for the demand men must have a reserve for emergencies; they must not be living from hand to mouth; they must through insurance or its equivalent be able to average wages over good and bad times and to subsist without demoralization till they can be reabsorbed again after industrial transformations. Those two measures are complementary and, in some sense indeed, alternative to one another. The better the supply of labor is able to follow the demand, the less will it have to wait for the demand. The greater the power of waiting for the demand, that is to say, the higher the rate or the better the distribution of wages, the less need is there for movement.

It is a policy of establishing the standard of life upon a longer and broader basis. An individual is not self-supporting unless his earnings amount to a sufficiency for life and not merely to a sufficiency for the time of working. An industry is not self-supporting unless it yields wages not only for the time of employment but also for the time of inevitable unemployment as well—unless it maintains all the men required by it both while they are in active service and while they are standing in reserve.

Appendixes deal with public labor exchanges in Germany, methods of seeking employment in Great Britain, report of the [British] Departmental Committee on Vagrancy, and a bibliography.

Mechanical Drawing.

Reviewed by ALFRED H. KNIGHT.*

NOTES ON PRACTICAL MECHANICAL DRAWING.—Written for the Use of Students in Engineering Courses. By Victor T. Wilson, Professor of Drawing and Design at the Michigan Agricultural College, East Lansing, Mich., and Carlos L. McMaster, Associate in General Engineering Drawing at the University of Illinois, Urbana, Ill. Third edition, revised and enlarged. East Lansing, Mich.: The Authors. Cloth; 6 × 9¼ ins.; pp. 186; 80 illustrations in the text. $1.50.

This book has been prepared for use as a text, in connection with elementary drawing courses in engineering schools. As stated by the authors, instruction in drawing can best be given personally, but often, particularly with large classes, it is convenient to have a suitable text for reference.

The authors have endeavored to include only that which is really needed in the production of mechanical drawings; consequently, geometrical constructions, which occupy such a large amount of space in some of the older works on drawing, have been reduced to a minimum. Moreover, such constructions are not used as exercises in drawing, but the effort is made to get the student started on actual working drawings as soon as possible.

An abundance of dimensioned sketches is furnished, from which the student is expected to make complete drawings. These sketches, however, are intended for use only when models are not available. The value of an ability to make good free-hand sketches from the object itself is appreciated by the authors, and some good suggestions regarding this kind of drawing are made.

Some excellent advice is given on the subject of lettering, and a number of alphabets well adapted to practical use are shown. The use and care of instruments is discussed at considerable length, and many ideas of great value to the beginner are presented.

Orthographic projection is clearly explained by the use of a number of well designed figures. The principles of isometric and oblique drawing, which are occasionally useful to the engineer, are also considered briefly.

Some of the conventions in common use are explained, but it appears that the explanations could be made much clearer to the student by the use of more cuts. The same is true of the remarks made upon the conventional methods used in taking sections.

In a long chapter on working drawings, the authors discuss the various steps in making a working drawing, such as preliminary layouts, selection of scale to be used, arrangement of details, dimensioning, tracing, checking, etc. The treatment of this subject is very satisfactory and shows a good agreement with the methods of modern American practice.

In some instances greater clearness could be obtained by an improvement in style, but, as a whole, the book is to be commended, particularly for its practicality.

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BRUECKEN IN EISENBETON.—Ein Leitfaden für Schule und Praxis. By C. Kersten. Part II.: Bogenbrücken. Second edition, revised and enlarged. Berlin, Germany: Wilhelm Ernst & Sohn. Paper; 6½ × 9¾ ins.; pp. 198; 466 illustrations in the text. 5.2 marks; American price, $2. Bound, 6 marks; American price, $2.40.

A notice of the first edition of this volume appeared in this Supplement on Feb. 20, 1908. Evidently there has been a satisfactory demand for the work in Germany, since a new edition is issued after only two years. The new arches in reinforced concrete built since 1907 are included in the new edition. We quote from our earlier notice:

> The treatment is almost wholly descriptive, and the text notes are supplemented by an abundance of drawings of the structures mentioned.

which statement fully characterizes the present edition also. American work finds only occasional scant mention.

NEUERE WASSERKRAFTANLAGEN IN NORWEGEN.—By E. Dubislav, Regierungs- und Baurat in Münster. Munich and Berlin, Germany: R. Oldenbourg. Paper; 6¾ × 9¾ ins.; pp. 174; 140 illustrations in the text. 5 marks; American price, $2.

To translate the title "Modern Hydraulic Power Plants in Norway" is to give a complete statement of the contents of Mr. Dubislav's book. He shows maps of the several hydrologic areas, states their principal power resources, and describes what has been done toward exploiting them. None of the plants described are very large, or specially remarkable except for the fact that most of them had to include provision for log-rafting, and some had also to provide lock-canals around the dams for navigation.

To those interested in either conservation or corporation control, there is interesting matter in a chapter on laws and legislation in Norway. This chapter shows that Norway has for 20 years had very advanced statutes concerning corporations, property ownership and power concessions. For example, real estate may be acquired only by citizens, or by corporations controlled by citizens, unless special governmental permission is obtained.

THE POLAR PLANIMETER.—How It Is Used, and How It Operates. A Simple Treatise. By Frank J. Gray, Assoc. M. Inst. C. E. London, England: St. Bride's Press, Ltd. Paper; 4¾ × 7¼ ins.; pp. 57; 29 illustrations in the text. 1 s., net; American price, 50 cts.

Mr. Gray writes for the man who wants to get a full insight into the action of the polar planimeter without a word of algebraic shorthand. Therefore he compels the reader to absorb 57 small pages of text. Under the same condition no one else could present the subject as effectively in less space, we believe. The author's presentation is very successful. That the matter first appeared in an English periodical and is here only reprinted should not militate against its usefulness.

ELECTRIC RAILWAY TROUBLES AND HOW TO FIND THEM.—A Comprehensive Treatise on Motors, Motor Operation, Motor Repairs, Car Break-Downs, Control Systems, Repairing of Control, Air Brakes, Air Brake Troubles, and Electric Railway Operation Generally. By Paul R. Lowe, M. E. Chicago: Frederick J. Drake & Co. Cloth; 5½ × 8 ins.; pp. 367; 118 illustrations in the text. $1.50.

Innumerable practical points, brought out only by the experience that a repairman or a motorman would be expected to gain, are combined in this volume with what an engineer would call bits of very elementary theory. The book is intended for mechanics and seems admirably to fill their needs. It is a welcome addition to books of this class, which in times past have too often been loosely compiled, or disjointedly written. It may be best briefly described as a guide to the proper inspection, testing and repair of motors, controllers, lighting arresters, substation apparatus, and the minor electrical fittings of an electric car.

A Compilation of Data Regarding Electric Power Conductors.

Reviewed by HENRY H. NORRIS.*

ELECTRIC POWER CONDUCTORS.—By Wm. A. Del Mar, Assoc. M. Am. Inst. E. E., Assoc. Inst. E. E., Assistant Engineer of the Electrical Transmission Department, New York Central R. R. New York: D. Van Nostrand Co. Cloth; 5¼ × 7¾ ins.; pp. 339; 69 illustrations in the text. $2, net.

The chief worth of this book results from the fact that it contains a mass of valuable information which Mr. del Mar has found useful in his work. From his former association with the Interborough Rapid Transit Co. (New York City) and his present relation to the New York Central Railroad he is in a position to know the nature of the problems presented for solution to the transmission engineer.

The book is a compilation of data and calculation methods gathered from a number of trustworthy sources. As stated in the preface, none have been included which the author has not carefully studied and found reliable. The various notes and quotations have been arranged in handbook style, which is "choppy" but convenient for reference. Liberal use has been made of the work of Prof. Harold Pender and other authorities, for which due credit is given. All of the information is classified and arranged in what the author considers the logical order. The successive topics are: determination of material, insulation, size, specifications, and installation of electrical conductors.

As suggested above, the book is apparently the outgrowth of the author's collection of memoranda and clippings having some bearing upon power transmission. These vary from short notes (for example, on the effect of water upon rubber insulation, or the use of a tallow candle as flux for tinning copper) to formulas for the deflection of an elastic catenary, involving hyperbolic functions. In some cases articles or sets of specifications are quoted at length, in others merely the conclusions are stated. Many of the memoranda are evidently based directly upon the author's experience. These detached bits of information have been sorted, arranged in the order previously mentioned and tied together very loosely by a few excellent generalizations. As would be expected, some chapters contain many topics, others very few; some are short (7 pages each), while others are long; some are consistent with their titles, others contain irrelevant matter, etc. As an example of the last-named, there are found under the heading, Electrical Properties of Conductors, 6½ pages devoted to the resistance of networks of conductors. As the equations deduced require the use of determinants, it has been considered necessary to give and illustrate the rules for their use as in a treatise on algebra.

It is proper to compare this new book with the standard text-book in the same field, Dr. F. A. C. Perrine's Electrical Conductors. The general scope of the two books is the same, but Mr. del Mar's contains information on railway circuits not contained in the other. There are also more reference tables in it. Dr. Perrine's book is greatly superior from the literary standpoint. It shows long and careful study of the manner of presentation of each topic, and each of the several divisions of the subject is given its share of attention resulting in excellent proportion. There is evidence of originality and authoritativeness. Attention to these features in the next edition of the Electric Power Conductors would enhance its value.

A TEXT-BOOK OF PHYSICS.—Edited by A. Wilmer Duff. Second edition, revised. Philadelphia, Pa.: P. Blakiston's Son & Co. Cloth; 5¼ × 8½ ins.; pp. 698; 525 illustrations in the text. $2.75, net.

Here is the second edition of a text-book on which several teachers of physics collaborated with no little success. In our review of the first edition, Sept. 17, 1908, the work was characterized as concise, accurate and well balanced. That applies equally to the new edition, in which a few changes have been made. The only criticism made in our former review has now been satisfied

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by the inclusion, at appropriate points near the close of each section, of references to more extended or exhaustive works. In the problems, collected at the close of each section, marginal heads in black type have been used to segregate the groups. Many of the problems themselves have been changed. The subject matter on wave motions generally has been rewritten by Prof. E. P. Lewis, of the University of California.

Variable Flow In Water Pipes.

ALLGEMEINE THEORIE UEBER DIE VERAENDERLICHE BEWEGUNG DES WASSERS IN LEITUNGEN.—Part I. By Lorenzo Allièvi. Translated from the Italian by Robert Dubs and V. Bataillard. Part II.: Stollen und Wasserschloss. By Robert Dubs. Berlin, Germany: Julius Springer. Paper; 6½ × 9¾ ins.; pp. 296; 35 illustrations in the text. 10 marks; American price, $4.

An excellent study of the hydraulic conditions existing in a water-pipe along which a valve is being opened or closed, in other words a study of variable (the author originally had it "perturbed") flow in pipes, appeared in the Italian journal "Annali della Società degli Ingeneri ed Architetti" in 1903. The author was Mr. L. Allièvi, a civil engineer. The study was wholly mathematical, and rather involved. Still the subject is so important that a wider dissemination of the work was desirable. A French translation was published the following year (in Révue de Mécanique) and now the present German translation appears.

The phenomenon of water-hammer in service pipes is one of the manifestations of variable flow in pipes. Mr. N. Simin's experimental study of this phase of the subject affords sufficient clearness concerning it, for the present. But a vastly more troublesome case of variable flow arises in hydraulic power-plants supplied by long penstocks. Whenever the load on such a plant varies, the governor opens or closes the gates, thereby admitting more water or less, and requiring the flow in the penstock to be either accelerated or retarded. Any change in flow, however, means that pressure variations will exist during the period of change. When the gate is closed (wholly or partly), the pressure in the penstock jumps to a high value momentarily, and in fact a wave of excess pressure runs through the pipe to the headbay and thence is reflected back, losing intensity until it dies out. These variations involve danger to the pipe, for one thing. Also, they tend to neutralize the action of the governor, sometimes seriously enough to supply actually more power to the water-wheel after partial closure of the gate than before the governor went into action.

Various effective devices are at hand for minimizing or eliminating this undesirable action. Just now the surge tank is perhaps the most popular of them, and properly so, as it compensates both when the gates open and when they close. A relief-valve discharging at the end of the penstock into a bypass to tailwater, as used at the Ontario Power Co.'s plant for example, is another useful protective. The deflecting needle-nozzle used in impulse-wheel plants has precisely the same function. But before the engineer proceeds to instal such devices, he ought to know what is going on in the penstock, or what would happen if he did not use them. The analytical predetermination of these actions is the purpose of the mathematical studies in this book.

This general statement will suffice to describe the nature of the first and main part of the work, if we add that the mathematical work is clear enough to give no trouble to the reader fairly conversant with ordinary calculus operations. The second half, written by one of the translators, Mr. Dubs, deals with the combination of headbay and supply tunnel, in high-head mountain plants, to determine the variations of water-level in the headbay during variations of draft. This is almost as important for the study of regulation as the pressure variation in the penstock, for the gross head on the turbine in such a plant is the height of the headbay level above the turbine, and when, with increased output, the headbay level is reduced, or when it is momentarily reduced during the opening of the turbine gates, the turbine works under decreased head and its governing is affected in somewhat the same way as by the pressure variations in the penstock. Headbays with and without overflow are dealt with in Mr. Dubs' study, and the influence of supply-tunnel friction is considered.

THE CALCULATIONS OF GENERAL CHEMISTRY.—With Definitions, Explanations, and Problems. By William J. Hale, Ph. D., Assistant Professor of Chemistry in the University of Michigan. New York: D. Van Nostrand Co. Cloth; 4¾ × 7¼ ins.; pp. 174. $1, net.

To help along the general mathematical trend of modern chemical instruction, accompanying the extension of the physicist's viewpoint, Prof. Hale has presented the methods of making the principal and typical calculations in concise and simple form.

There is first a brief discussion of the units of measurement and of density and specific gravity ratios. A considerable part of the book following shows the calculations for gases—change of volume with pressure and temperature, the phenomena of "partial pressures" and Avogadro's hypothesis that equal volumes carry equal numbers of molecules. The law of definite proportions of all chemical combinations is illustrated, and the interpretation and derivation of chemical formulas—H_2O, H_2SO_4, $AgNO_3$, etc.—are used as stepping stones to the use of chemical equations for representing actual chemical reactions.

So far the book is familiar to most scientific readers who have had the more general courses in chemistry usually offered in college. The calculation of normal solutions—those mutually neutralizing and equivalent, volume for volume—calculations of combinations of gases by volume and the derivation of chemical equations for reactions wherein an element changes in valence, all these less familiar matters are taken up in the latter part of the book.

The author's method is notable. The calculations for the separate conditions and actions are taken up separately and finally all the conditions are considered together for the development of a complete calculation. Much of the text will be found useful in even such elementary instruction as that given in high schools.

THE ISTHMIAN CANAL.—By H. H. Rousseau, Civil Engineer, U. S. Navy, Member Isthmian Canal Commission. Presented at the 20th Annual Session of the Trans-Mississippi Commercial Congress, Held at Denver, Colo., Aug. 16-21, 1909. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.; pp. 53.

This is a reprint of a very interesting paper on the Panama Canal read at Denver last August. The paper gives the most complete and yet concise summary of the canal enterprise, its history and present status, that we have anywhere seen. Copies of the paper can doubtless be obtained on request from the Canal Commission's office at Washington.

Concerning the newspaper discussion of a few months ago over the comparative merits of a lock and a sea-level plan, Admiral Rousseau says:

> On June 29, 1906, the construction of a lock type of canal was authorized by Congress in accordance with the general plans of the so-called minority of the Board of Consulting Engineers and the work has since been carried on along these lines. During the three years which have elapsed, nothing has occurred on the work which has occasioned uneasiness on the part of those most intimately and responsibly concerned with the execution of the work, or which has caused them to doubt either the wisdom of this choice or the ultimate success of the undertaking; and at this late date with the lock canal far advanced a discussion on the relative merits of a lock versus sea-level canal is about as much out of date as a last year's spring bonnet. . . . There is no engineering, commercial, or military reason for considering a sea-level plan at this stage of the work. . . . The United States has already spent over $20,000,000 toward the construction of locks, which would be wasted were a change to a sea-level canal now made.

REPORT ON NATIONAL VITALITY.—Its Wastes and Conservation. Bulletin of the Committee of One Hundred on National Health, Prepared for the National Conservation Commission by Prof. Irving Fisher, of Yale University, Member of the Commission. July, 1909—No. 30. Published monthly by the Committee (Executive Secretary, 69 Church St., New Haven, Conn.) Paper; 5¾ × 9¼ ins.; pp. 138; one diagram.

A general idea of the scope of this interesting and valuable report may be given by quoting the titles of the four parts into which it is divided, as follows: "The length of life versus mortality; the breadth of life versus invalidity; methods of conserving life; results of conserving life." The part on conservation methods deals with conservation through heredity, public hygiene (including the work of municipalities, of the state and of the nation), semipublic hygiene, and personal hygiene. The new science of eugenics—if it can be said that eugenics has yet reached the dignity of a science—is discussed in this section. We will not attempt to outline the contents of the bulletin further, as it can, we presume, be readily obtained on application to the Executive Secretary, whose address is given above. The report deserves wide and careful reading and attention.

THE NATIONAL ASSOCIATION OF THE MASTER PLUMBERS OF THE UNITED STATES.—Report of the Sanitary Committee, 1907-1908-1909. (David Craig, Chairman.) (Address Walter D. Nolan, 721 14th St., N. W., Washington, D. C., for copies of report.) Paper; 5¾ × 8¾ ins.; pp. 85; folding and other plates, and text illustrations.

The greater portion of this pamphlet is taken up with reports by Prof. C.-E. A. Winslow, of the Massachusetts Institute of Technology, on "The Sanitary Significance of Bacteria in the Air of Drains and Sewers." A summary of Professor Winslow's valuable paper on this subject was published in Engineering News of Sept. 2, 1909. In addition to Professor Winslow's paper, there is a brief report on the corrosion of water pipes in cities in the Middle West, by Prof. Earle B. Phelps, Assoc. Am. Soc. C. E., of the Massachusetts Institute of Technology (also of 30 Church St., New York City), and a brief report by the committee itself giving the results of some tests to determine the efficiency of the steel of various traps used in plumbing.

CONTRIBUTIONS FROM THE SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.—Massachusetts Institute of Technology, Vol. V. Reprinted Papers. Boston, Mass.: The Institute. Paper; 5½ × 8¾ ins.; pp. 279; folding and other plates, and text illustrations. $1.

The articles here presented are reprints of papers or reports which have appeared elsewhere. Three of the five papers are by Prof. Earle B. Phelps. Two of them, dealing with stream pollution by sulphite pulp waste and disinfection of sewage filter effluents, were published during the present year as Water-Supply Papers 226 and 229, respectively, of the United States Geological Survey. The third contribution by Professor Phelps is on the corrosion of water pipes. It is reprinted from the 1907-1908-1909 report of the Sanitary Committee of the National Association of Master Plumbers of the United States. From the last-named source is also reprinted Prof. C.-E. A. Winslow's important paper on bacteria in the air drains and sewers (see Eng. News, Sept. 2, 1909). The fifth paper, embodying the results of investigation of the sanitary condition of the Gowanus Canal, Brooklyn, is written by Mr. C. F. Breitzke, and is reprinted from the "Technology Quarterly" (Mass. Inst. Tech.). A brief introduction to the volume is contributed by Prof. W. T. Sedgwick.

MORTALITY STATISTICS: 1908.—Bulletin 104, Bureau of the Census; E. Dana Durand, Director. General Death Rates, Causes of Death, Occupational Mortality, Second Decennial Revision of the International Classification of Causes of Death. Washington, D. C.; Pub. Doc. Paper; 9 × 11½ ins.; pp. 133.

For several years past the Census Bureau has published an annual volume of mortality statistics. Although the volume covering the year 1908 will appear earlier in relation to the date of the statistics than previous volumes, yet the Bureau is showing its appreciation of the value of prompt publication of such figures by issuing the present bulletin of advance information. The bulletin gives in considerable detail many mortality figures for 1908, prefaced by a very interesting analysis and discussion of general death rates, causes of death, and occupational mortality. The bulletin also contains a copy of the second revision of the international classification of causes of death, made at Paris in 1909.

These mortality statistics relate only to registration states and cities for those portions of the country whose vital statistics are sufficiently nearly accurate to make them worthy of compilation and publication. At the close of 1908, 17 states were included in the registration area, besides the District of Columbia, and 74 cities

in non-registration states. The registration area included an estimated population of a little over 45,000,000, or 51.8% of the estimated population of the United States. The registration states include all six of the New England States, New York, New Jersey, Pennsylvania and Maryland of the Middle Atlantic States, Indiana, Michigan and Wisconsin in the Central West, and South Dakota, Colorado, California and Washington in the farther West. During 1909 Ohio was added to the registration area, thus bringing the population in this area up to 55.2%. It is expected, and much to be hoped, that further additions to the registration area will be made by the beginning of 1910, so as to increase the value of the mortality statistics for the calendar year 1910, which statistics will be greatly heightened in value by the fact that the enumeration of the population of the whole country will be made in that year.

CONCRETE.—By John C. Trautwine, Jr., and John C. Trautwine, 3d, Civil Engineers. Reprinted from Trautwine's "Civil Engineer's Pocket-Book," 19th Edition, 100th Thousand, 1909. New York: John Wiley and Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ x 7½ ins.; pp. 200 (about); text illustrations. $2.

In the 19th edition of Trautwine's "Civil Engineers' Pocket-Book," revised and brought down to 1909, some 200 pages are devoted to the subject of cement and concrete, in place of the few scattered references in the previous editions. These pages, together with a few on the general principles of strength of materials, have been published in a separate book, from the same plates as the main book, but on heavier paper, and bound in boards instead of the familiar flexible backs of the pocket-book.

Very evidently the object of this volume is to present a digest of current practice in concrete and reinforced concrete in as condensed a form as possible. To do this the authors have carefully abstracted about everything that has been written on the subject, taking the meat from each separate article, and have arranged these abstracts in the most concise manner possible. The abstracts take up the nature of the material, its testing and manner of preparation. They are followed by extracts from experiences of various authorities, arranged by number but indexed under subjects at the beginning of the section, and finally by a compilation of all the best specifications on cement and concrete.

From the very nature of the book—the necessity for abbreviation, the curtailment of explanation, in short, the pocket-book style—the smaller work on concrete is not of much use as a textbook. But as a short-hand record of present practice for one who is versed in the general principles of concrete construction, the reprint is warranted.

BIEGUNG, SCHUB UND SCHERUNG.—In Stäben von Zusammengesetzten und Mehrteiligen Querschnittsformen mit Gleichen und Wechselnden Trägheitsmomenten. (With examples and graphic charts.) By R. Sonntag, Regierungsbaumeister. Berlin, Germany: Wilhelm Ernst & Sohn. Paper; 6¾ x 9¾ ins.; pp. 222; 173 illustrations in the text and 11 plates. 8 marks; American price, $3.20. Bound, 9 marks.

We find in this peculiar book frequent reference to a "new theory" and "shearing-force theory." Apparently this "theory" is the subject-matter of the book. What it consists of is hard to determine, unless through a far more thorough study of the text than we have been able to make. We judge that the author's "theory" is that ordinary stress-calculations of say a plate-girder are in error by neglecting the action of various longitudinal shears. The error is of chief importance in unsymmetrical sections, such as angles, channels or Z-bars used as beams. In these, for instance, the longitudinal shear between web and flange induces lateral deflection of the flange and secondary vertical deflection of the whole shape, not to mention a twisting of the flange due to the downward drag of the web along one edge only. The maximum longitudinal stress-intensity is considerably increased by these actions. Further, the maximum combined stress, due to combination of longitudinal stress and shear, needs to be calculated, this being the real criterion of safety. The author has therefore computed shears for a large number of points in a beam, and therefrom the combined stress, and has drawn stress-distribution curves in considerable variety.

There are dozens of solid pages of arithmetical calculations in the book, all concerned with shears and combined stresses, in plate-girders, irregular sections, rolled shapes, and in reinforced-concrete beams. Numerous detail comments that are appropriate and interesting appear in the text, but we discover no conclusions that would indicate the author's purpose or results.

The matter on steel beams is not without interest, as a commentary on the conventional character of all "common theory of flexure" calculations, and on the secondary actions which occur in beams of unsymmetrical section; but it is so undigested as to make exorbitant demands on the reader's time and attention. The absence of stated conclusions or results makes the state of affairs still worse.

Similar comment must be passed on the part dealing with shears in reinforced-concrete beams. This subject is so unexplored that any discussion of it is apt to invite attention. The present contribution to it may be meritorious, but we were quite unable to discover this, as there is nothing to indicate what the author's calculations show.

We note that the author insists on a fundamental distinction between "Schub" and "Scherung," both of which are shear; he describes the former as being shear associated with bending, while "Scherkräfte' are shearing forces free from all bending, such as might theoretically occur in a plate cut apart in a shearing-machine. The distinction seems wholly illusory. Repeated reference to it indicates that it is vital to the author's "theory," but just how we have not been able to discover.

FARM WATER SUPPLIES OF MINNESOTA.—By Karl F. Kellerman, Physiologist in Charge of Water Purification Investigations, and H. A. Whittaker, Scientific Assistant, Water Purification Investigations, in cooperation with the Minnesota State Board of Health. Bulletin No. 154, Bureau of Plant Industry, U. S. Department of Agriculture; B. T. Galloway, Chief of Bureau, Washington, D. C.: Pub. Doc. Paper; 6 x 9¼ ins.; pp. 87; 73 figures in the text.

An unique contribution to rural sanitation has been made by the authors of this bulletin. Their general plan of procedure was to visit a farm, make diagrams of farm buildings and of sanitary surroundings with particular reference to water-supplies and dairies, and collect samples of water which were subsequently analyzed both chemically and bacterially. The report includes condensed notes and diagrams giving the conditions found at each farm, together with tables of analyses, the latter classified according to character of water-supply. The conclusions of the study, as might be expected, are that "both

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farm and city are suffering from the careless management of rural sanitation," and a large proportion of the farm water-supplies investigated were polluted.

The Analysis of Rigid Frames and Other Statically Indeterminate Systems.

DIE BERECHNUNG VON STEIFRAHMEN.—Nebst Anderen Statisch Unbestimmten Systemen. By Ejnar Björnstad. Berlin, Germany: Julius Springer. Paper; 6½ x 9½ ins.; pp. 229; 1 folding plate; 127 text illustrations, and 19 tables. 9 marks; American price, $3.60. Cloth, 10 marks; American price, $4.

Rigid connections characterize modern structural steelwork—both in the bridge and in the building field—so extensively that it is not so very inaccurate to say that every steel structure as well as each one of its component parts is statically indeterminate. To take a single instance that will be found in every bridge of recent design: The floorbeams are riveted to the posts by a deep connection, and as a floorbeam deflects it tends to tilt the posts inward; but a fairly strong strut of the lateral system in the unloaded chord stays the ends of the posts, and prevents the tilting, so that the posts bend instead of tilting, the floorbeam connection is subjected to a bending moment by no means negligible in amount, and the floorbeam itself has a reduced deflection. Similar assemblages are found all through our bridges and buildings, in places where for our calculations we assume simple determinate jointed frames.

It is not customary to analyze such rigid assemblages for their "secondary" stresses. Nor is it clear that it would be worth the time and labor to make this complex analysis, in most cases. The bridge engineer should, however, be competent to enter into this extra detail when necessary; and we feel safe in saying that many cases occur in practice where the rigid assemblage employed should be computed for its bending stresses.

A helpful aid for such calculations is afforded by the book before us, the first publication of its kind. Its title, "The Analysis of Rigid Frames and Other Statically Indeterminate Systems," indicates the field covered, except that we should note that no multiple frames (as constituted by a multi-tier building skeleton where beams and columns are rigidly connected) are included, but only simple frames, while the "other statically indeterminate systems" refers to trussed wooden beams, certain forms of roof-truss, etc.

The author's method is as follows: He develops formulas for the deflection of several types of statically determinate frames or semi-frames, representing the conversion forms of the indeterminate frames later described. For this he employs exclusively the method (credited to Prof. Mohr) wherein the moment diagram of the loads is in its turn taken as the loading, and the moment curve of the latter then represents the deflection curve for the original loads. On the basis of the deflection formulas so obtained, the author takes up consecutively each type of frame included in the book) and each arrangement of loading which may affect it; cutting the frame to make it determinate, he writes the equations for the linear and angular deflections of the cut ends, due to the loads, from the previous formulas, and also for the linear and angular deflections due to assumed stresses at the junction, wherefrom by combination he obtains formulas for the stresses required to bring the cut ends into contact and alinement. The latter are the actual stresses, of course, existing at the location of the imaginary cut. Most of his analyses he then illustrates by numerical examples.

He also gives tables for abbreviating the analysis of rigid four-piece frames, wherein the dimensions of the several members are reduced to a common unit. But these have only an accessory value, if any.

The arrangement of the analyses is unfortunately such that it is not easy to pick out from it a set of formulas for a given frame. The reader of the book must first of all study it throughout; and under this condition a single frame analysis, it seems, would have served as a sufficient type solution for all.

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MECHANICAL DRAWING FOR TRADE SCHOOLS.—By Charles C. Leeds, Assistant to Head of School for Apprentices and Journeymen, Carnegie Technical Schools. New York: D. Van Nostrand Co. Cloth; 10¾ × 8¼ ins.; numerous illustrations. $2, net.

The method of arrangement of this book at once commends itself for its simplicity and convenience. Opening at any point subsequent to the introductory lessons explaining the use of the common drawing implements, one finds on the right-hand page the full-page reproduction of a drawing which is explained in the text on the left-hand page. The explanatory matter, while brief, is of a concisely practical nature and gives instruction on points more often left to be learned from the instructor.

The first part of the book teaches the use of T-square, triangle, compass and ruling pen and imparts by means of simple exercises a knowledge of the elementary principles involved in the representation of objects by mechanical drawings. There are lessons, too, on lettering, free-hand sketching and section lining. Projection is explained in simple, direct language with the assistance of a diagram and as an exercise on this subject the student is required to complete the plan and one elevation of several drawings of which only one elevation is given complete in the book. The making of sectional views, "assembly drawings," and drawings to scales other than full size is taught by well chosen examples to be reproduced by the student. The explanatory notes point out the reasons for the methods of dimensioning shown and the examples are so arranged that a few new points are introduced in each exercise. The geometrical problems commonly met in drafting are next taken up, including the construction of cycloids and involutes for gear teeth and the projection and development of the curves of intersection of cones and cylinders. Working drawings of spur and bevel gears are taken up at this point.

The next section of the book presents in several separate lessons the various details of a 12-in. speed lathe and finally the student is required to make a complete assembly drawing of the lathe from the information given in the details. Two lessons on the tabulation of standard data and on "composite drawings" (one drawing for a given part manufactured in several different sizes with dimensions tabulated by the use of reference letters) are followed by a number of exercises calculated to widen the student's experience, and develop mechanical skill in drafting. The final lessons give some information on worm gearing and cams and the conventional signs and methods used in connection with structural drafting.

The aim of the book throughout is, apparently, to compress into the limits of the 58 lessons, or plates, as much as possible of the usable technical knowledge of drafting. It can scarcely be considered to be, in a higher sense, a text book of mechanical drawing, but it presents a course of lessons which is well designed to make a reasonably competent draftsman of anyone who conscientiously goes through with it, and it will minimize the need of a personal instructor.

The peculiar "musical" finish sign proposed in the "Universal Dictionary of Mechanical Drawing," by Geo. H. Fallows, is used throughout the book together with back slanting foot and inch marks in the dimensioning. Aside from this, however, the illustrations are very faithfully representative of current drafting-room practice.

CONCRETE POTTERY AND GARDEN FURNITURE.—By Ralph C. Davison, Assistant Secretary, Concrete Association of America. New York: Munn & Co. Cloth; 5 × 7½ ins.; pp. 196; 140 illustrations in the text. $1.50.

As the author states in his preface, the generally accepted notion of concrete is a material for purely utilitarian purposes, for bridges, buildings, foundations and other structures where mass and strength is needed. In the past, however, the very ancient past of Greece and Egypt, the cement of that day, analogous in its service to our cement though of a somewhat different composition, was used in the fine arts as a plastic material to be molded and cast into numerous decorative units. This application of an old art to modern uses is the subject of Mr. Davison's little book. It describes with great detail and many illustrations and drawings the methods to be pursued in casting on a small scale such things as vases, garden tables, benches, fence posts, ornaments, bas-reliefs, etc. The explanations are clear enough so that any one with a facility in handicraft and an ordinary amount of artistic appreciation can learn to make at home a number of very pretty articles for the decoration of the home and garden.

COORDINATES OF ELEMENTARY SURVEYING.—By J. C. L. Fish, M. Am. Soc. C. E., Professor of Railroad Engineering in Leland Stanford, Jr., University. Stanford University, Cal.: The Author. Flexible cloth; 6 × 9¼ ins.; pp. 68; 50 figures in the text. $1.

In the course of nearly a decade of teaching surveying and of observation of field methods in actual work, Prof. Fish has become convinced that, in the usual methods of teaching the subject, the importance of instrument manipulation has overshadowed the fundamental geometrical concepts of surveying. This difficulty manifests itself in an inability to check results and to approach a new problem in a scientific manner. As a remedy he developed some years ago a new method of instruction, in which the first course on the subject of surveying was merely an enlargement of the course on coordinate geometry, so that the mathematical processes of computation could be studied, as the author says, "independent of the circumstances of surveying, namely, personnel, equipment, nature of the survey and of the ground."

In the book noted above, which is an enlargement of the usual blue-print sheets for students used in the class-room for some years back, the ordinary problems of location and area determination are solved by the use of rectangular and polar coordinates. The notation and the methods used are entirely novel for this style of book, and it is stated that involved explanation has been purposely avoided because the text is to be used as an adjunct to class-room instruction. This novel system and the lack of explanation of the

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methods employed make it difficult to form an estimate of the book. As it stands it seems to be a remarkably complicated system for teaching the fairly simple processes of surveying, but if the student is well grounded in coordinate geometry, this application of that subject may help him in mastering the fundamental principles of surveying. But the methods will certainly have to be taught by one who is very familiar with the system and the student will have to avoid all other text-books on the subject, for the standard nomenclature and theories in most books on surveying will tend only to confuse him.

LANDSLIDES IN THE SAN JUAN MOUNTAINS, COLORADO.—Including a Consideration of Their Causes and Their Classification. By Ernest Howe. Professional Paper No. 67, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 8⅝ × 11½ ins.; pp. 58; 20 plates and 4 text figures.

The San Juan Mountain region in western Colorado is distinguished among other things by remarkably extensive evidences of former earth and rock slides and falls. From some points of view the most noteworthy of these are the so-called "rock streams," tongues of rock debris projecting out from the foot of a cliff in some cases as far as three-quarters of a mile and characterized by certain topographic and structural peculiarities. Mr. Howe, the author of the above publication, has discovered the origin of rock streams. As he convincingly demonstrates, they are the debris of large rock falls from a steep cliff face upon a rather flat valley floor or shelf. The great Turtle Mountain catastrophe at Frank, Alberta (Eng. News, June 4, 1903), supports this explanation.

The pamphlet finds its chief end, apparently, in proving the case of these rock streams, and describing and illustrating a number of notable instances. This makes appeal to the geologist chiefly, perhaps. But in connection herewith the author describes many other earth and rock slides, of great variety, in fact the whole range of such appearances as found in the San Juan district. This matter is all of much interest to the engineer, and not least because of its bearing on the intricate but fascinating subject of earth slides in water-permeated clay soil, such as occasionally threaten the security of the engineer's works. Thus, one of the slides described was a slumping of an immense area of soft soil in a flat, poorly-drained headwater region; another is an instance of slow continued slip of part of a steep earth slope covered with forest growth; still another, the Slumgullion mud flow, is a case of softened underlying strata squeezed out by the capping rocks of the mountain and flowing down a valley for more than six miles in a narrow stream.

There is no proper reason of unity of subject for including in the one monograph all the large diversity of slides and falls which evidence themselves in the San Juan region. Rock falls—mountain spalling—and earth slips or slumps or flows are so radically different that their heterogeneous intermixture in a descriptive and analytical treatise like this one operates only to confuse the reader's conceptions. Yet for our purposes we need not take exception to Mr. Howe's monograph on this score, for he brings together a fine collection of photographic views, all of them interesting and instructive, and a great amount of suggestive description. To every one who feels any interest whatever in earth movements the pamphlet recommends itself as a very desirable acquisition and an entertaining bit of technical reading. It will help to open ones eyes to the probability that earth and rock slips have played a vastly extensive part in molding our topography, even though the geology text-books do not say so.

NATIONAL ASSOCIATION OF CEMENT USERS.—Proceedings of the Annual Convention Held at Cleveland, Ohio, Jan. 11-16, 1909. Vol. V. Edited by the President (Richard L. Humphrey, Harrison Building, Philadelphia, Pa.) Published by the Association (Geo. C. Wright, Secy., 35 Grand Ave., Rochester, N. Y.) Paper; 6 × 9 ins.; pp. 649; text illustrations and folding sheets.

The National Association of Cement Users is one of the many technical societies in this country in which the program of the annual convention is so long as to become tedious. Last year the meeting at Cleveland included nine long

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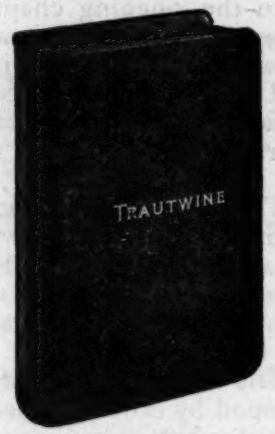

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sessions, each of which was devoted to the reading and discussion of technical papers. Long before the end of this time the greater number of the members in attendance had become weary with much listening and had taken themselves either to the more pleasant hotel corridors below or to their respective homes. This is an unfortunate condition, for the papers read were of the greatest interest to concrete users, and were by far the best read in any of the five annual meetings of the association so far held.

However, a number of the papers were of such nature as not to be appreciated properly when read, so that the publication of the lot in the annual volume noted above, makes available particularly desirable matter. As noted in our account of the convention, the Cleveland meeting specialized in the costs and the artistic treatment of concrete, so that the most recent data and ideas on these two important items are recorded in the latest "Proceedings."

An Artemus Ward on Electrical Engineering.

ELECTRICITY EXPLAINED.—By J. Calvin S. Tompkins. New York: Cochrane Publishing Co. Cloth; 4¾ × 7½ ins.; pp. 64; text illustrations. $1.

If any electrical engineer wants to entertain a few fellow members of his profession some evening, let him gather them around his fireside and read this book to them. If you don't believe it look at a few of these "explanations."

We do not know what electricity is any more than we know what is lightning. Many theories have been advanced as to what men think this peculiar force is, but as yet we cannot say that we can define it. And yet we can see it and hear it. And we also can hear lightning. You say we can hear only the explosive discharge of lightning. Yes; but we can hear lightning itself, the moment it flashes, even though it is far from us. How? Simply by connecting a telephone receiver between the gas pipe and the water pipe in the house.

This leads us to wonder if the author, in his boyhood, ever placed a conch shell to his ear "to hear the waves roar." He continues:

Whenever you see lightning flashes, foretelling an approaching storm, put the receiver to your ear and listen, and you will hear the lightning bizz-zz as it discharges. This is static electricity discharging in the atmosphere. Now static electricity is electricity at rest, which, when disturbed, discharges with considerable force. And force, as an electrical term, means volts. The atmosphere is full of this static electricity, and when it becomes heavy with it, or, in other words, when the atmosphere is fully charged with electricity, it breaks loose in severe discharges, which often prove fatal to destructible things within its path. . . .

Every one knows what a horseshoe magnet is, but not every one knows that one of the greatest principles of applied electricity lies in the construction of such a magnet. Without a permanent magnet in the form of a steel needle, the ships of the sea would not venture to sail beyond the horizon, for there is a drawing magnetism of the earth, the composition of which has not yet been discovered, near the North Pole, which attracts this needle of the mariner's compass. . . .

A piece of iron is composed of molecules of iron ore, welded together in a mass, which when heated in a furnace will expand. The red-hot horseshoe that a blacksmith is hammering looks very much thicker when he takes it out of the furnace than it does when he has finished hammering it. And it is made steel by crowding these molecules together. So we see that even while in a solid mass these molecules can be made to change their shape. . . .

To this day the direct current is mostly produced chemically. For this reason it is one of the most expensive currents produced, and is not used where other currents will do the work. But there are cases where necessity demands it. For instance, the telegraph and also the telephone are dependent upon the direct current. With an alternating current the telegraph relay would rattle like a loud buzzer every time the distant operator depressed his transmitting key in sending messages. And if we were to talk over the telephone wires with an alternating current, our voices would quiver.

[With emotion at the phenomenon would they quiver, no doubt.—Ed.]

The alternating current already mentioned is produced by machinery. From the word we know that this current must alternate, going backward and forward, as it does. This is the cheapest commercial electric current produced, and by the aid of step-down or step-up transformers can be carried a great distance and increased or decreased in voltage at will. Alternating current is measured by its voltage. There is not much amperage to it. . . .

We have found how the direct current was discovered by Galvini, and improved by Volto when he placed a piece of silver and a piece of zinc in a glass of salt water and produced a current of electricity. . . .

Many experimenters have developed the chemical production of the direct current of electricity since then, and to-day we have more than twenty-five liquid cells of different makes, and about one hundred different kinds of dry cells. . . . But the primary battery is still being improved, and it is claimed that some of the latest of these cells are powerful enough to light several electric lamps, when attached to the feed wires of a house wired for electric lights. When this becames practical it will take the place of the central station system for house lighting.

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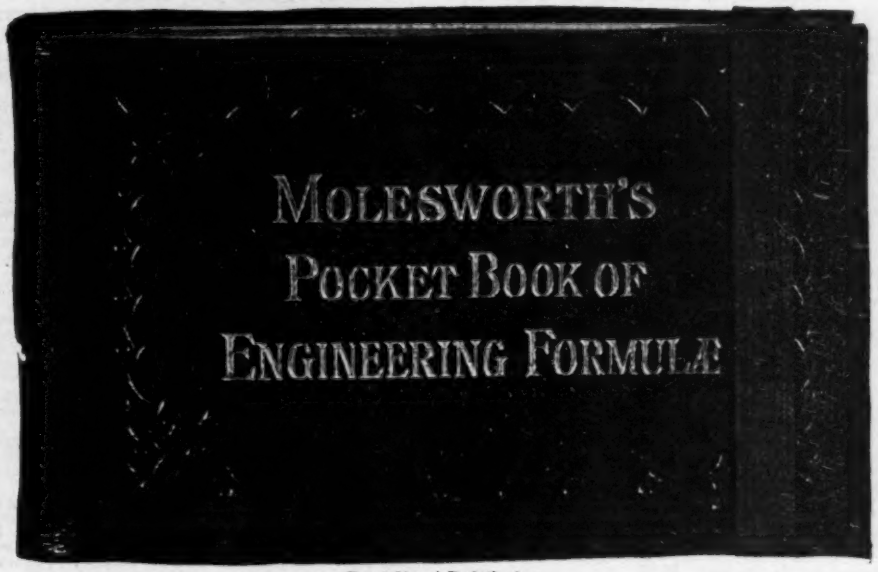

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Publications Received.

ASSOCIATION OF ONTARIO LAND SURVEYORS.—Annual Report, and Proceedings at the Annual Meeting Held at Toronto, Feb. 23-25, 1900. (Killaly Gamble, Secy., Toronto, Ont.) Paper; 6 × 8¾ ins.; pp. 237; illustrated.

BITUMINOUS COAL TRADE ASSOCIATION.—Bituminous Coal Production and Shipments in Pennsylvania, Maryland and West Virginia, 1908. (Henry S. Fleming, Secretary of Association, 1 Broadway, New York.) Stiff paper; 7 × 9¾ ins.; pp. 95.

BOARD OF RAILROAD COMMISSIONERS (Iowa).—Annual Report for the Year Ending Dec. 7, 1909. (Dwight N. Lewis, Secy.) Des Moines, Ia.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 444.

BOARD OF SUPERVISING ENGINEERS, CHICAGO TRACTION.—First Annual Report, Covering the Period Ended Jan. 31, 1908. Chicago, Ill.: The Board (Bion J. Arnold, Chairman). Cloth; 6 × 9 ins.; pp. 462; folding and other plates.

THE BREEDE RIVER IRRIGATION WORKS.—By T. E. Scaife, Assoc. M. Inst. C. E. (A Paper read at the Annual Meeting of the South African Association for the Advancement of Science at Bloemfontein, on Sept. 28, 1909.) Paper; 5¼ × 7½ ins.; pp. 9.

THE BUILDING CODE OF THE CITY OF LOUISVILLE.—Compiled and Published under the Supervision of the Department of Buildings. Marshall Morris (M. Am. Soc. C. E.), Inspector of Buildings. Louisville, Ky.: Department of Buildings. Cloth; 6 × 9¼ ins.; pp. 243.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9¼ ins.

No. 387: Structural Materials in Parts of Oregon and Washington. By N. H. Darton. Pp. 33; 9 plates and 1 text figure.

No. 392: Commercial Deductions from Comparisons of Gasoline and Alcohol Tests on Internal-Combustion Engines. By Robert M. Strong. Pp. 38.

No. 393: Incidental Problems in Gas-Producer Tests. By R. H. Fernald, C. D. Smith, J. K. Clement and H. A. Grine. Pp. 29; 8 text figures

No 395: Radioactivity of the Thermal Waters of Yellowstone National Park By Herman Schlundt and Richard B. Moore. Pp. 35; 4 plates and 7 text figures.

No. 399: Results of Spirit Leveling in West Virginia, 1896 to 1908, Inclusive. Compiled by S. S. Gannett and D. H. Baldwin, in cooperation with the West Virginia State Geological Survey during 1901 to 1908, inclusive. Pp. 81.

No. 402: The Utilization of Fuel in Locomotive Practice. By W. F. M. Goss. Pp. 28; 8 text figures.

No. 403: Comparative Tests of Run-of-Mine and Briquetted Coal on the Torpedo Boat "Biddle." Made with the collaboration of Lieut. Commander Kenneth McAlpine, U. S. N., and Ensign J. W. Hayward, U. S. N., by Walter T. Ray and Henry Kreisinger. Pp. 49; 10 text figures.

CONCRETE INSPECTION.—A Manual of Information and Instructions for Inspectors of Concrete Work, with Standard and Typical Specifications. By Charles S. Hill, Associate Editor "Engineering-Contracting," Author of "The Chicago Main Drainage Channel," etc. Chicago and New York: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 3½ × 6¼ ins.; pp. 179; 15 illustrations in the text. $1, net.

THE DYNAMO.—Its Theory, Design and Manufacture. By C. C. Hawkins, M. Inst. E. E., Assoc. Am. Inst. E. E., and F. Wallis, M. Inst. E. E. Fifth edition, rewritten, revised and enlarged. In two volumes. New York: The Macmillan Co. London, England: Whittaker & Co. Cloth; 5¾ × 9 ins.; pp. 1134; 594 illustrations in the text. $5.50, net.

DIE EISENKONSTRUKTIONEN.—Nebst einem Einhang, Enthaltend Zahlentafeln für das Berechnen und Entwerfen Eiserner Bauwerke. By L. Geusen. Berlin, Germany: Julius Springer. Cloth; 7¾ × 11 ins.; pp. 290; 2 plates, 518 text illustrations, and 16 tables. 12 marks; American price, $4.80.

ELECTRIC WAVES.—An Advanced Treatise on Alternating-Current Theory. By William Suddards Franklin, Professor of Physics in Lehigh University. New York: The Macmillan Co. London, England: Macmillan & Co. Cloth; 5½ × 8¾ ins.; pp. 315; 250 illustrations in the text. $3, net.

ETUDE COMPLEMENTAIRE SUR LA STABILITE DU MATERIEL DES CHEMINS DE FER.—Théorie des Déraillements. Profile des Bandages. By Georges Marié. (Extracts from Mémoires de la Société des Ingenieurs Civils de France. Bulletin de Mai, 1900.) Paris (VI°), France: H. Dunod & E. Pinat. Paper; 7¼ × 10½ ins.; pp. 54; 11 illustrations in the text. 2 francs; American price, 60 cts.

FUEL TESTS WITH ILLINOIS COAL.—(Compiled from Tests Made by the Technologic Branch of the U. S. Geological Survey, at the St. Louis Fuel Testing Plant, 1904—June 30, 1907.) By L. P. Breckenridge and Paul Diserens. Circular No. 3, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 54; 16 figures in the text.

THE GEOLOGY OF ORE DEPOSITS.—By H. H. Thomas, M. A., and D. A. MacAlister, Assoc. R. S. M. London, England: Edward Arnold. New York: Longmans, Green & Co. Cloth; 4¾ × 7½ ins.; pp. 416; 65 illustrations in the text. $2.50.

INCORPORATED ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.—Proceedings, Vol. XXXV., 1908-9. Edited by Thomas Cole, Assoc. M. Inst. C. E., Secretary of the Association. London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½ × 8¾ ins.; pp. lxix. + 342; numerous folding plates. $8.50.

INDIANA ENGINEERING SOCIETY.—Proceedings, Annual Meeting Held at Indianapolis, Ind., Jan. 14-16, 1909. Indianapolis, Ind.: The Society (Charles Brossmann, Secy., Union Trust Building). Paper; 6 × 9 ins.; pp. 332; plates and text illustrations. 50 cts.

INVESTIGATION OF CENTRIFUGAL PUMPS.—Part II.: Experiments with a Six-Inch Horizontal Centrifugal Pump Comparing the Efficiency of Circular and Spiral Cases and Showing the Effect of Air Leakage. By Clinton Brown Stewart. Bulletin of the University of Wisconsin, No. 318. Researches in Hydraulics, Daniel W. Mead, Professor of Hydraulic and Sanitary Engineering. Madison, Wis.: The University. Paper; 6 × 9¼ ins.; pp. 130; 24 text illustrations and 29 tables. 50 cts.

LABORATORY NOTES ON IRON AND STEEL ANALYSES.—By Walter Macfarlane, Principal of the Metallurgical Department, Staffordshire Education Committee. London, New York and Bombay: Longmans, Green & Co. Cloth; 5 × 7¾ ins.; pp. 462; 25 illustrations in the text. 7s. 6d., net; American price, $2.50, net.

THE LOSS OF WATER IN NEW YORK'S DISTRIBUTION SYSTEM.—By Lindon Bates, Jr. Issued by the General Committee on Water Supply Committee on Reports (New York City). Paper; 6 × 9 ins.; pp. 58; illustrated.

METAL SPINNING.—By Fred D. Crawshaw, Assistant Dean, College of Engineering, University of Illinois. Chicago, Ill.: Popular Mechanics Co. Cloth; 4¾ × 7 ins.; pp. 72; illustrated. 25 cts.

THE MINERAL RESOURCES OF THE PHILIPPINE ISLANDS.—With a Statement of the Production of Commercial Mineral Products during the Year 1908. Issued by Warren D. Smith, Ph. D., Chief of the Division of Geology and Mines, Bureau of Science. Manila, P. I.: Pub. Doc. Paper; 7½ × 10½ ins.; pp. 49; five plates and one text figure.

MINERAL RESOURCES OF THE UNITED STATES, CALENDAR YEAR 1908.—Advance Chapters. U. S. Geological Survey, George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

The Production of Iron Ores, Pig Iron and Steel, in 1908. By E. C. Harder. With a Note on the Value of Pig Iron in 1908, by W. T. Thom. Pp. 78; two plates (in pocket) and one text figure.

The Production of Glass Sand, Other Sand, and Gravel, in 1908. Prepared under the direction of Ernest F. Burchard. Pp. 8.

Statistics of the Clay-Working Industries in the United States in 1908. By Jefferson Middleton. Pp. 52.

MUNICIPAL GOVERNMENT.—By Frank J. Goodnow, LL.D., Eaton Professor of Administrative Law and Municipal Science in Columbia University. New York: The Century Co. Cloth; 5¾ × 9 ins.; pp. 401. $3, net.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—Papers, Reports and Discussions, 32d Convention, Atlantic City, N. J., June 1-4, 1909. In three volumes. Vol. I.: General Session. Vol. II.: Technical and Commercial Sections. Vol. III.: Accounting Section and Executive and Public Policy Committees. (John F. Gilchrist, Secy., c/o Commonwealth Edison Co., Chicago, Ill.) Cloth; 6 × 9¼ ins.; pp. clxviii. + 652, lx. + 832, and lx. + 503; text illustrations in each volume.

NEW SOUTH WALES.—Official Year Book, 1907-8. John B. Trivett, F. R. A. S., Government Statistician. Sydney, N. S. W.: Pub. Doc. Boards; 6 × 10 ins.; pp. 564; one folding map.

OHIO ELECTRIC LIGHT ASSOCIATION.—Proceedings of the Annual Convention Held at Toledo, O., July 13-15, 1909. (D. L. Gaskill, Secy., Greenville, O.) Cloth; 6 × 9 ins.; pp. 134; folding and other plates, and text illustrations.

OHIO ENGINEERING SOCIETY.—Proceedings, Annual Meeting, January, 1909. Published by the Society (Clyde J. Knisely, Secy., New Philadelphia, O.). Paper; 6 × 9 ins.; pp. 200; folding and other plates, and text illustrations. 50 cts.

OSCILLATIONS DE LACET DES VEHICULES DE CHEMINS DE FER.—By Georges Marié. (Extract from "Annales des Mines," 1st semestre, 1909.) Paris (VI°), France: H. Dunod & E. Pinat. Paper; 6½ × 9¾ ins.; pp. 104; 11 illustrations in the text. 3 francs; American price, 90 cts.

PORTLAND CEMENT SIDEWALK CONSTRUCTION.—Based upon the Experience of Many Successful Contractors. Second edition, enlarged and revised. Compiled by P. B. Beery. Chicago, Ill.: Cement and Engineering News. Paper; 5½ × 7¾ ins.; pp. 46; two text illustrations. 50 cts.

THE PREVENTION OF INDUSTRIAL ACCIDENTS.—No. 1: General Pamphlet. Prepared by Frank E. Law and William Newell, of the Staff of The Fidelity and Casualty Co. of New York. New York: The Fidelity and Casualty Co. Paper; 5½ × 7¾ ins.; pp. 194; 72 illustrations in the text. 25 cts.

LE PYROMETRE THERMO-ELECTRIQUE POUR LA MESURE DES TEMPERATURES ELEVEES.—By H. Pécheux, Professor of Electricity at l'Ecole Nationale d'Arts et Métiers at Aix. Paris, France: Gauthier-Villars, and Masson & Cie. Paper; 4½ × 7½ ins.; pp. 184; 28 illustrations in the text.

RAILROAD AND WAREHOUSE COMMISSION (Illinois).—38th Annual Report. Railroads for the Year Ending June 30, 1908; Grain Inspection Department for the Year Ending Oct. 31, 1908; Office Expenses for the Year Ending Nov. 30, 1908. (William Kilpatrick, Secy.) Springfield, Ill.: Pub. Doc. Flexible leather; 5½ × 8½ ins.; pp. 820; plates and folding sheets.

SEWAGE TREATMENT AT MANCHESTER, ENGLAND, 1908-9.—Annual Report of the Rivers Department, City of Manchester, for the Year Ending March 31, 1909. (John Frowde, Chairman Rivers Committee.) London, England: P. S. King & Son. Paper; 6 × 9¾ ins.; pp. 26; 10 folding diagrams and 22 tables. 2s. 6d.; American price, $1.

SOLID BITUMENS.—Their Physical and Chemical Properties and Chemical Analysis. Together with a Treatise on the Chemical Technology of Bituminous Pavements. By S. F. Peckham, Chemist to the Department of Finance, City of New York. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6 × 9¼ ins.; pp. 324; 29 illustrations in the text. $5, net.

THE STEAM ENGINE.—A Concise Treatise for Students and Engineers. By Charles H. Benjamin, Dean of the Schools of Engineering, Purdue University. Brattleboro, Vt.: The Technical Press. Cloth; 5¾ × 9¼ ins.; pp. 316; 198 illustrations in the text. $3.

THE STERILIZATION PLANT OF THE JERSEY CITY WATER SUPPLY CO. AT BOONTON, N. J.—By Dr. J. L. Leal.—Description of the Process and Plant of the Jersey City Water Supply Co. for the Sterilization of Water of the Boonton Reservoir; by George W. Fuller.—Description of Methods and Operation of the Sterilization Plant of the Jersey City Water Supply Co., at Boonton, N. J., and Discussion of Results of Analysis of Raw and Treated Water, with Notes of Cost of Treatment; by George A. Johnson. (Reprints from Papers read at the Annual Convention of the American Water Works Association, Milwaukee, Wis., June 7-12, 1909; J. M. Diven, Secy., Charleston, S. C.) Paper; 6 × 9 ins.; pp. 231 to 281; illustrated.

A TEXT BOOK ON GRAPHIC STATICS.—By Charles W. Malcolm, Assoc. M. Am. Soc. C. E., Assistant Professor of Structural Engineering, University of Illinois. New York and Chicago: The Myron C. Clark Publishing Co. London, England: E. & F. N. Spon, Ltd. Cloth; 6 × 9¼ ins.; pp. 316; 155 illustrations in the text. $3, net.

A TEXT BOOK OF ORE DRESSING.—By Robert H. Richards, LL.D., Professor of Mining Engineering and Metallurgy at the Massachusetts Institute of Technology, Boston, Mass., Author of "Ore Dressing." Assisted by Earl S. Bardwell and Edwin G. Goodwin. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 702; 354 illustrations, mostly in the text. $5.

THEORETICAL ELEMENTS OF ELECTRICAL ENGINEERING.—By Charles Proteus Steinmetz, A. M., Ph. D. Third edition, thoroughly revised and greatly corrected. New York: McGraw-Hill Book Co. Cloth; 6 × 9½ ins.; pp. 455; 239 illustrations in the text. $4, net.

THEORIE UND PRAXIS DER AUSGLEICHUNGSRECHNUNG.—By Siegmund Wellisch. Vol. I.: Elemente der Ausgleichungsrechnung. Vienna, Austria, and Leipzig, Germany: Carl Fromme. Paper; 6¾ × 10 ins.; pp. 275; one plate and seven text figures. 10 marks; American price, $4.

THEORY OF FLOATING TUBES.—By Frank Gilman. (Reprinted from the Annals of Mathematics, Second Series, Vol. II., No. 1, October, 1900.) Paper; 9¼ × 11¼ ins.; pp. 20; three illustrations in the text.

A TREATISE ON CONCRETE, PLAIN AND REINFORCED.—Materials, Construction, and Design of Concrete and Reinforced Concrete. With Chapters by R. Feret, William B. Fuller, Frank P. McKibben and Spencer B. Newberry. By Frederick W. Taylor and Sanford E. Thompson, M. Am. Soc. C. E., Consulting Engineer. Second edition. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6 × 9 ins.; pp. 807; 253 illustrations, mostly in the text. $5.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.

No. 232: Underground Water Resources of Connecticut. By Herbert E. Gregory. With a Study of the Occurrence of Water in Crystalline Rocks, by E. E. Ellis. Pp. 200; 5 plates and 31 text figures.

No. 242: Surface Water Supply of the United States, 1907-8. Part II. South Atlantic Coast and Eastern Gulf of Mexico. Prepared under the direction of M. O. Leighton, by M. R. Hall and R. H. Bolster. Pp. 226; 3 plates and 1 text figure.

WESTERN RAILWAY CLUB.—Official Proceedings for the Club Year 1908-9. Published by the Club (J. W. Taylor, Secy., 390 Old Colony Building, Chicago, Ill.) Cloth; 6 × 9 ins.; pp. 303; text illustrations and one folding plate.

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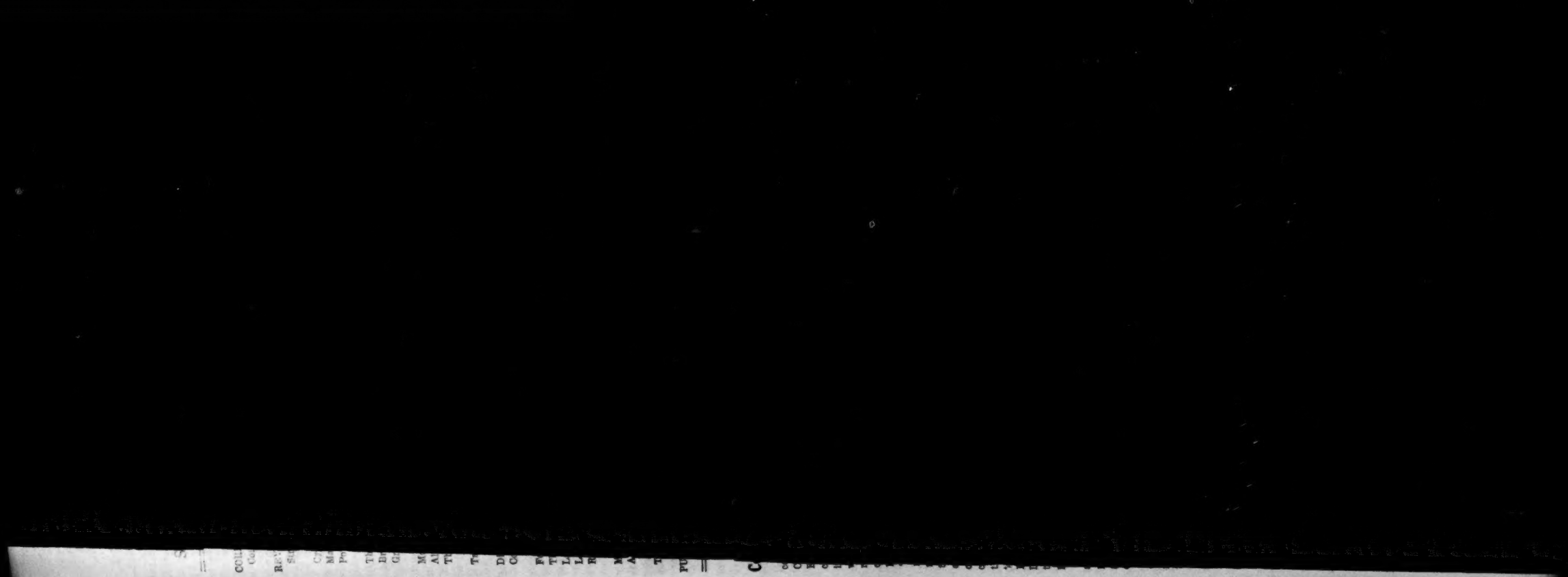
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